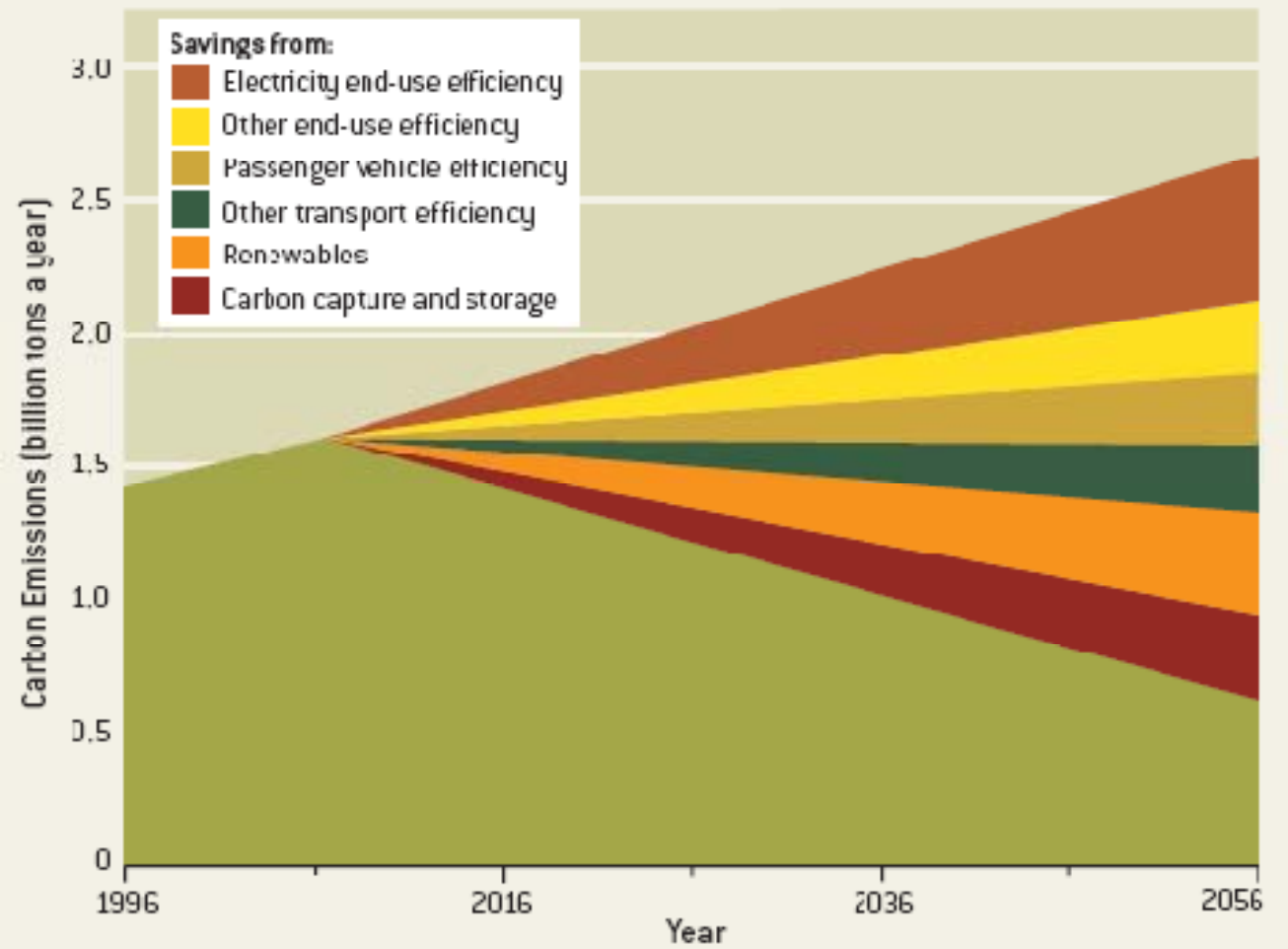
Assessment of Natural Gas Combined Cycle Plants with Carbon Capture and Storage (CCS)

January 14, 2010

The Role for Carbon Capture and Storage

- Carbon Capture and Storage is recognized as necessary to meeting long-term climate change goals.



Source: NRDC

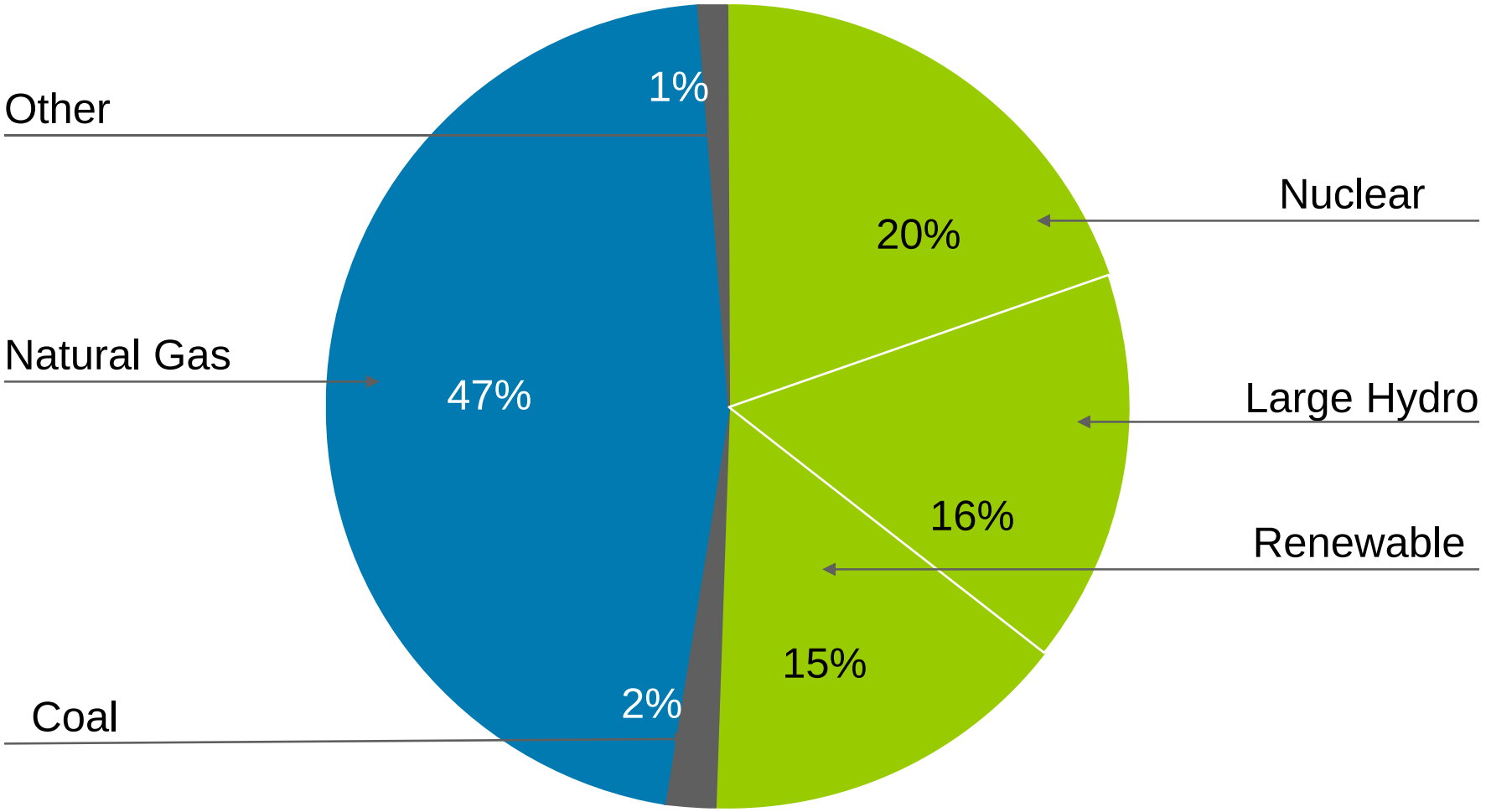
Pacific Gas and Electric Company

- One of the largest combination natural gas and electric utilities in the United States
- What we do: deliver safe, reliable, and environmentally responsible gas and electricity to approximately 15 million Californians

Number of distribution customers:	**5.1 MM electric 4.2 MM gas**
Electric transmission circuits:	**18,610 miles**
Gas transmission backbone:	**6,136 miles**
Electric generation capacity:	**6,000 MW**
Service territory	**70,000 sq miles**

PG&E estimated 2009 portfolio mix

On average, more than 50% of PG&E's Portfolio is renewable or carbon-free



Based on PG&E's November 2008 ERRA forecast.

Note: Delivery mix includes all of PG&E's owned generation plus all of PG&E's power purchases.

PG&E perspective on NGCC+CCS

- California has established ambitious Greenhouse Gas ("GHG") emissions reduction targets
- We are aggressively procuring renewable energy, but need to simultaneously pursue the development of other low-carbon energy options, including CO2 capture at fossil power plants
- California's electric sector GHG emissions are dominated by natural gas power plants and it is important to understand the feasibility of retrofitting these plants with CCS technologies
- If we begin exploring these opportunities to deploy CCS in California now, CCS could provide a meaningful contribution to the 2020 GHG emission reduction targets

Assessment of Natural Gas Combined Cycle (NGCC) Plants with CO2 Capture and Storage will help California expand its options for meeting GHG reduction targets

PG&E perspective on NGCC+CCS (cont'd)

- PG&E follows the California loading order for procurement of electricity and has one of the lowest emissions rates in the state
  - Loading order: energy efficiency, demand response, renewables and distributed generation, clean and efficient conventional generation
- Natural gas remains a significant source of energy for PG&E but most plants are owned by Independent Power Producers (IPPs)
  - Long-term contracts
  - Short-term supply markets
  - Owned generation
- Some of the plants that are operational today will be around many years from now
- A detailed understanding of how CCS applies to natural gas power plants is needed to inform PG&E's long term procurement strategy

PG&E's primary objective is to gain a deep understanding of the costs, feasibility and potential for retrofitting NGCC power plants with CCS technology in California

PG&E's role in the assessment

- Work with the WESTCARB team to develop and apply a methodology to identify NGCC plants in PG&E's service territory
- Assist in developing criteria to prioritize the plant types:
  - Best suited to retrofit
  - Most applicable in California
  - Suitable for the most promising CCS technologies assessed as part of the study
- PG&E is providing an in-kind contribution to the project consisting of staff labor with the requisite plant and engineering expertise
- In addition, PG&E will provide non-confidential information, including historic dispatch and operations data, service territory maps, and other non-proprietary in-house resources
  - PG&E will seek to cooperate and collaborate with IPPs as well

Questions?